(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 326 386**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 89300759.1

(22) Date of filing: 26.01.89

(51) Int. Cl.⁴: C 07 D 217/24
C 07 D 405/06, A 61 K 31/47

(30) Priority: 27.01.88 GB 8801772
12.08.88 GB 8819221

(43) Date of publication of application:
02.08.89 Bulletin 89/31

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

(71) Applicant: MAY & BAKER LIMITED
Dagenham Essex RM10 7XS (GB)

(72) Inventor: Ashton, Michael John
c/o May & Baker Limited
Dagenham Essex, RM10 7XS (GB)

Bridge, Andrew William
c/o May & Baker Limited
Dagenham Essex, RM10 7XS (GB)

Chambers, Robert Keith
c/o May & Baker Limited
Dagenham Essex, RM10 7XS (GB)

Dron, Donald Ian
c/o May & Baker Limited
Dagenham Essex, RM10 7XS (GB)

Fenton, Garry
c/o May & Baker Limited
Dagenham Essex, RM10 7XS (GB)

Harris, Neil Victor
c/o May & Baker Limited
Dagenham Essex, RM10 7XS (GB)

Lythgoe, David John
c/o May & Baker Limited
Dagenham Essex, RM10 7XS (GB)

McFarlane, Ian Michael
c/o May & Baker Limited
Dagenham Essex, RM10 7XS (GB)

Newton, Christopher Gregory
c/o May & Baker Limited
Dagenham Essex, RM10 7XS (GB)

Riddell, David
c/o May & Baker Limited
Dagenham Essex, RM10 7XS (GB)

Smith, Christopher
c/o May & Baker Limited
Dagenham Essex, RM10 7XS (GB)

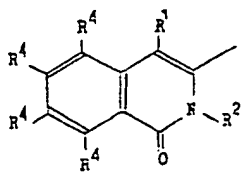
Stuttle, Keith Alfred James
c/o May & Baker Limited
Dagenham Essex, RM10 7XS (GB)

Toft, Malcolm Percy
c/o May & Baker Limited
Dagenham Essex, RM10 7XS (GB)

(74) Representative: Bentham, Stephen et al
J.A. Kemp & Co. 14 South Square Gray's Inn
London WC1R 5EU (GB)

(54) **Isoquinolinones.**

(57) Therapeutically useful isoquinolinone derivatives of the formula A-X-R³, wherein A represents a group of the formula:



wherein R¹ and R² represents cycloalkyl, alkyl, alkenyl or alkynyl optionally substituted by halogen or cycloalkyl, or represents optionally substituted aryl or heteroaryl, R⁴ represents hydrogen, halogen, optionally substituted alkyl, alkenyl or alkynyl, optionally substituted aryl or heteroaryl, or a group R⁶O- wherein R⁶ represents alkyl, aryl or arylalkyl, X represents

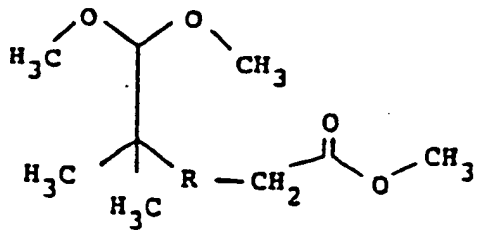
EP 0 326 386 A2

AP4

ethylene or vinylene, R^3 represents a group of the formula:-
$-Y^1-CH_2-CH(OH)-CH_2-COOR^5$
wherein Y^1 represents carbonyl, hydroxymethylene or $-C(OR)_2$-wherein R represents alkyl or the two R symbols together represent alkylene and R^5 represents hydrogen or optionally substituted alkyl or R^3 represents a lactol or lactone ring, and pharmaceutically acceptable salts thereof, processes for their preparation and compositions containing them are described.

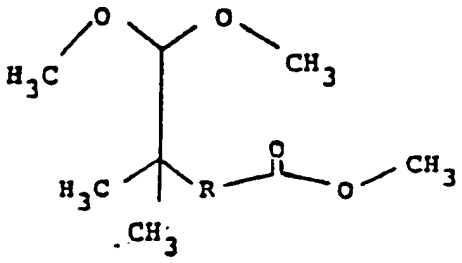
24. The compound as claimed in claim 19, which is 14-allyl-14-hydroxy-2,2-dimethyl-16-heptadecen-1-ol.

25. A compound of th general formula



and the pharmaceutically acceptable salts thereof, wherein R is an alkane or an alkene of 3 to 15 carbon atoms, with one or more degrees of unsaturation where R is an alkene.

26. A compound of the general formula



and the pharmaceutically acceptable salts thereof, wherein R is undecane or undecene.

27. The compound as claimed in claim 26, which is methyl 14,14-dimethoxy-13,13-dimethyl-11-tetradecenoate.

28. The compound as claimed in claim 26, which is methyl 14,14-dimethoxy-13,13-dimethyl tetradecanoate.

29. Use of a compound according to claim 1 for preparing a medicament for decreasing plasma cholesterol levels in a mammal.

30. Use according to claim 29 wherein said compound is 3-(13-hydroxy-12,12-dimethyl-tridecyl)-3-hydroxy glutaric acid.

31. Use according to claim 29 wherein said compound is 3-(12-carbomethoxy-12-methyl-tridecyl)-3-hydroxy glutaric acid.

32. Use according to claim 29 wherein said compound is 3-(12-carboxy-12-methyl-tridecyl)-3-hydroxy glutaric acid.

33. Use according to claim 29 wherein said compound is dimethyl 3-(12-carbomethoxy-12-methyl-tridecyl)-3-hydroxy glutarate.

34. The compound as claimed in claim 9, in which the pharmaceutically acceptable salt thereof is the sodium salt.

35. The compound as claimed in claim 10, which is the sodium salt thereof.

36. The compound as claimed in claim 11, which is the sodium salt thereof.

37. The compound as claimed in claim 12, which is the sodium salt thereof.

38. The compound as claimed in claim 13, which is the sodium salt thereof.

$-CH_2-\overset{O}{\overset{\|}{C}}-O-CH_3$

or $-CH_2-\overset{O}{\overset{\|}{C}}-OH$, R^4 and R^5 are both methyl and R^6 is selected from the group consisting of hydroxy, carboxy, methoxycarbonyl, or $-CH_2-OH$.

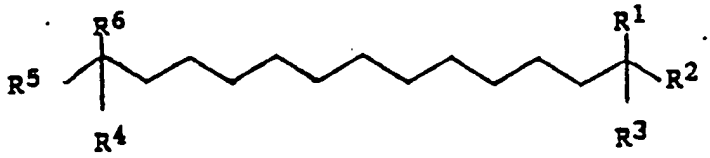
10. The compound as claimed in claim 9, which is 3-(13-hydroxy-12,12-dimethyl-tridecyl)-3-hydroxy glutaric acid.

11. The compound as claimed in claim 9, which is 3-(12-carbomethoxy-12-methyl-tridecyl)-3-hydroxy glutaric acid.

12. The compound as claimed in claim 9, which is 3-(12-carboxy-12-methyl-tridecyl)-3-hydroxy glutaric acid.

13. The compound as claimed in claim 10, which is dimethyl 3-(12-carbomethoxy-12-methyl-tridecyl)-3-hydroxy glutarate.

14. A compound of the general formula



and the pharmaceutically acceptable salts thereof, wherein R^1 and R^6 are independently -H, $-(CH_2)_n-O-H$, $-(CH_2)_n-\overset{O}{\overset{\|}{C}}H$, $-(CH_2)_n-\overset{O}{\overset{\|}{C}}-OH$, $-(CH_2)_n-\overset{O}{\overset{\|}{C}}-O-R^7$, $-CH(OCH_3)_2$ wherein R^7 is alkyl of from 1 to 10 carbon atoms, and n is an independent integer of from 0 to 10; wherein R^2 and R^3 are alkyl or alkenyl of from 1 to 5 carbon atoms; and wherein R^4 and R^5 are independently alkyl of from 1 to 10 carbon atoms.

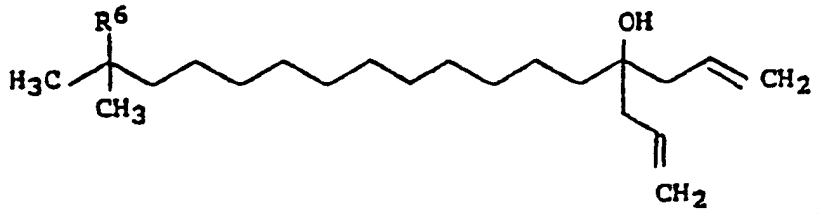
15. The compound as claimed in claim 14, wherein R^1 is -OH.

16. The compound as claimed in claim 14, wherein R^2 and R^3 are both $-CH_2-CH=CH_2$.

17. The compound as claimed in claim 14, wherein R^4 and R^5 are both $-CH_3$.

18. The compound as claimed in claim 14, wherein R^1 is -OH and R^6 is $-CO_2CH_3$.

19. A compound of the general formula



and the pharmaceutically acceptable salts thereof, wherein R^6 is $-CH_2-OH$, -OH, $-\overset{O}{\overset{\|}{C}}H$, $-CH(OCH_3)_2$ and $-\overset{O}{\overset{\|}{C}}-O-CH_3$.

20. The compound as claimed in claim 19, which is 17,17-dimethoxy 16,16-dimethyl-4-allyl-4-hydroxy-heptadecene.

21. The compound as claimed in claim 19, which is methyl 14-allyl-14-hydroxy-2,2-dimethyl-16-heptadecanoate.

22. The compound as claimed in claim 19, which is 14-allyl-14 hydroxy-2,2-dimethyl-16-heptadecenal.

23. The compound as claimed in claim 19, which is 14-allyl-14-hydroxy-2,2-dimethyl-16-heptadecenoic acid.

45. In a pharmacological agent for lowering plasma cholesterol lev ls in a mammal comprising an organic compound in a pharmaceutical composition, the improvement wherein the composition is that of claim 29.

46. The compound as claimed in claim 9, in which the pharmaceutically acceptable salt thereof is the sodium salt.

47. The compound as claimed in claim 10, which is the sodium salt thereof.

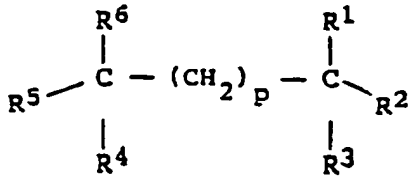
48. The compound as claimed in claim 11, which is the sodium salt thereof.

49. The compound as claimed in claim 12, which is the sodium salt thereof.

50. The compound as claimed in claim 13, which is the sodium salt thereof.

Claims for the following Contracting State : GR

1. A compound of the general formula



and the pharmaceutically acceptable salts thereof, wherein R^1, R^2, R^3 and R^5 are independently -H, $-(CH_2)_n-\overset{O}{\overset{\|}{C}}-O-H$, $-(CH_2)_n-\overset{O}{\overset{\|}{C}}-O-R^7$, $-(CH_2)_n-O-\overset{O}{\overset{\|}{C}}-(CH_2)_m$, $-(CH_2)_n-O-H$, $-(CH_2)_n-\overset{O}{\overset{\|}{C}}H$, wherein R^7 is alkyl of from 1 to 10 carbon atoms, n and m are independent integers of from 0 to 10; and wherein R^4 and R^5 are independently alkyl of from 1 to 10 carbon atoms, and p is an independent integer of from 9 to 13 carbon atoms.

2. The compound as claimed in claim 1, in which R^1 is -OH.

3. The compound as claimed in claim 1, in which R^2 and R^3 are both $-CH_2-\overset{O}{\overset{\|}{C}}-OH$.

4. The compound as claimed in claim 1, in which R^6 is -OH.

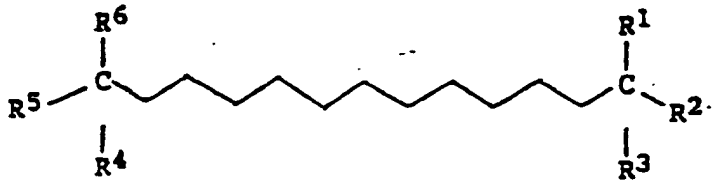
5. The compound as claimed in claim 1, in which R^6 is $-CH_2-OH$.

6. The compound as claimed in claim 1, in which R^6 is $-\overset{O}{\overset{\|}{C}}-O-CH_3$.

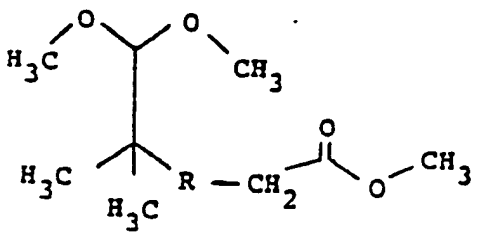
7. The compound as claimed in claim 1, in which R^6 is $-\overset{O}{\overset{\|}{C}}-OH$.

8. The compound as claimed in claim 1, in which R^4 and R^5 are both $-CH_3$.

9. A compound of the general formula

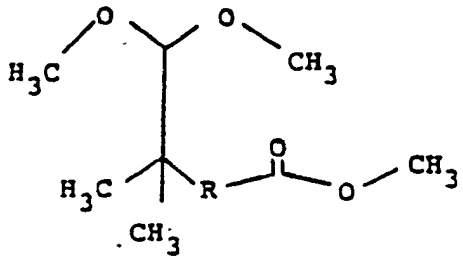


and the pharmaceutically acceptable salts thereof, wherein R^1 is hydroxy, R^2 and R^3 are both



and the pharmaceutically acceptable salts thereof, wherein R is an alkane or an alkene of 3 to 15 carbon atoms, with one or more degrees of unsaturation where R is an alkene.

26. A compound of the general formula



and the pharmaceutically acceptable salts thereof, wherein R is undecane or undecene.

27. The compound as claimed in claim 26, which is methyl 14,14-dimethoxy-13,13-dimethyl-11-tetradecenoate.

28. The compound as claimed in claim 26, which is methyl 14,14-dimethoxy-13,13-dimethyl tetradecanoate.

29. A pharmaceutical composition comprised of a pharmaceutically acceptable, non-toxic carrier in combination with a compound according to claim 1.

30. The composition of claim 29, wherein said compound is 3-(13-hydroxy-12,12-dimethyl-tridecyl)-3-hydroxy glutaric acid.

31. The composition of claim 29, wherein said compound is 3-(12-carbomethoxy-12-methyl-tridecyl)-3-hydroxy glutaric acid.

32. The composition of claim 29, wherein said compound is 3-(12-carboxy-12-methyl-tridecyl)-3-hydroxy glutaric acid.

33. The composition of claim 29, wherein said compound is dimethyl 3-(12-carbomethoxy-12-methyl-tridecyl)-3-hydroxy glutarate.

34. Use of a compound according to claim 1 for preparing a medicament for decreasing plasma cholesterol levels in a mammal.

35. Use according to claim 34 wherein said compound is 3-(13-hydroxy-12,12-dimethyl-tridecyl)-3-hydroxy glutaric acid.

36. Use according to claim 34 wherein said compound is 3-(12-carbomethoxy-12-methyl-tridecyl)-3-hydroxy glutaric acid.

37. Use according to claim 34 wherein said compound is 3-(12-carboxy-12-methyl-tridecyl)-3-hydroxy glutaric acid.

38. Use according to claim 34 wherein said compound is dimethyl 3-(12-carbomethoxy-12-methyl-tridecyl)-3-hydroxy glutarate.

39. Use of a composition according to claim 29 for preparing a medicament for decreasing plasma cholesterol levels in a mammal.

40. Use according to claim 39, wherein said composition is according to claim 30.

41. Use according to claim 39, wherein said composition is according to claim 31.

42. Use according to claim 39, wherein said composition is according to claim 32.

43. Use according to claim 39, wherein said composition is according to claim 33.

44. In a pharmacological agent for lowering plasma cholesterol l vels in a mammal comprising an organic compound, the improvement wherein th organic compound is that of claim 1.

or $-CH_2-\overset{O}{\overset{\|}{C}}-OH$, R^4 and R^5 are both methyl and R^6 is selected from the group consisting of hydroxy, carboxy, methoxycarbonyl, or $-CH_2-OH$.

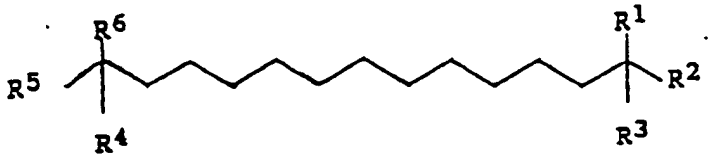
10. The compound as claimed in claim 9, which is 3-(13-hydroxy-12,12-dimethyl-tridecyl)-3-hydroxy glutaric acid.

11. The compound as claimed in claim 9, which is 3-(12-carbomethoxy-12-methyl-tridecyl)-3-hydroxy glutaric acid.

12. The compound as claimed in claim 9, which is 3-(12-carboxy-12-methyl-tridecyl)-3-hydroxy glutaric acid.

13. The compound as claimed in claim 10, which is dimethyl 3-(12-carbomethoxy-12-methyl-tridecyl)-3-hydroxy glutarate.

14. A compound of the general formula



and the pharmaceutically acceptable salts thereof, wherein R^1 and R^6 are independently -H,

$-(CH_2)_n-O-H$, $-(CH_2)_n-\overset{O}{\overset{\|}{C}}H$,

$-(CH_2)_n-\overset{O}{\overset{\|}{C}}-OH$,

$-(CH_2)_n-\overset{O}{\overset{\|}{C}}-O-R^7$, $-CH(OCH_3)_2$

wherein R^7 is alkyl of from 1 to 10 carbon atoms, and n is an independent integer of from 0 to 10; wherein R^2 and R^3 are alkyl or alkenyl of from 1 to 5 carbon atoms; and wherein R^4 and R^5 are independently alkyl of from 1 to 10 carbon atoms.

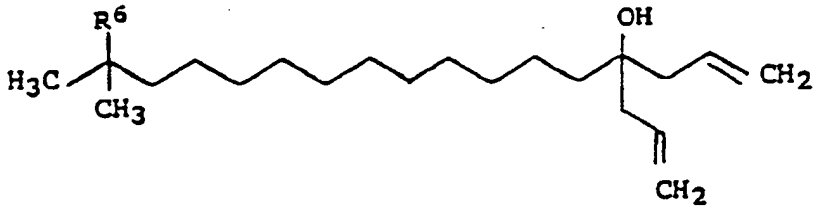
15. The compound as claimed in claim 14, wherein R^1 is -OH.

16. The compound as claimed in claim 14, wherein R^2 and R^3 are both $-CH_2-CH=CH_2$.

17. The compound as claimed in claim 14, wherein R^4 and R^5 are both $-CH_3$.

18. The compound as claimed in claim 14, wherein R^1 is -OH and R^6 is $-CO_2CH_3$.

19. A compound of the general formula



and the pharmaceutically acceptable salts thereof, wherein R^6 is $-CH_2-OH$, -OH,

$-\overset{O}{\overset{\|}{C}}H$, $-CH(OCH_3)_2$ and $-\overset{O}{\overset{\|}{C}}-O-CH_3$.

20. The compound as claimed in claim 19, which is 17,17-dimethoxy-16,16-dimethyl-4-allyl-4-hydroxy-heptadecene.

21. The compound as claimed in claim 19, which is methyl 14-allyl-14-hydroxy-2,2-dimethyl-16-heptadecanoate.

22. The compound as claimed in claim 19, which is 14-allyl-14-hydroxy-2,2-dimethyl-16-heptadecenal.

23. The compound as claimed in claim 19, which is 14-allyl-14-hydroxy-2,2-dimethyl-16-heptadecenoic acid.

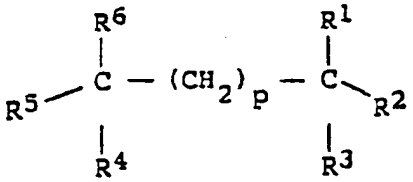
24. The compound as claimed in claim 19, which is 14-allyl-14-hydroxy-2,2-dimethyl-16-heptadecen-1-ol.

25. A compound of the general formula

in the responsiveness of the mammal treated, severity of hyperlipidemia, dosage related adverse effects, if any, observed and analogous considerations. Likewise, the specific pharmacological responses observed may vary according to and depending upon the particular active compound selected or whether different active compounds are used in combination or in the presence of suitable pharmaceutical carriers, as well as the type of formulation and mode of administration employed, and such expected variations or differences in the results are contemplated in accordance with the objects and practices of the present invention. It is intended therefore that the invention be limited only by the scope of the claims which follow, and that such claims be interpreted as broadly as is reasonable.

Claims

1. A compound of the general formula



and the pharmaceutically acceptable salts thereof, wherein R^1, R^2, R^3 and R^6 are independently -H, $-(CH_2)_n-\overset{O}{\overset{\|}{C}}-O-H$, $-(CH_2)_n-\overset{O}{\overset{\|}{C}}-O-R^7$, $-(CH_2)_n-O-\overset{O}{\overset{\|}{C}}-(CH_2)_m$, $-(CH_2)_n-O-H$, $-(CH_2)_n-\overset{O}{\overset{\|}{C}}H$, wherein R^7 is alkyl of from 1 to 10 carbon atoms, n and m are independent integers of from 0 to 10; and wherein R^4 and R^5 are independently alkyl of from 1 to 10 carbon atoms, and p is an independent integer of from 9 to 13 carbon atoms.

2. The compound as claimed in claim 1, in which R^1 is -OH.

3. The compound as claimed in claim 1, in which R^2 and R^3 are both $-CH_2-\overset{O}{\overset{\|}{C}}-OH$.

4. The compound as claimed in claim 1, in which R^6 is -OH.

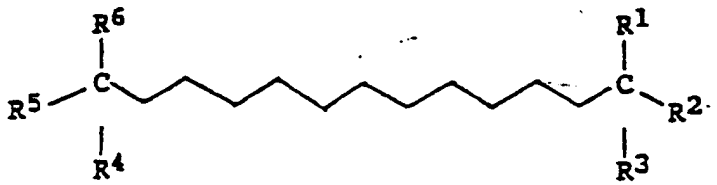
5. The compound as claimed in claim 1, in which R^6 is $-CH_2-OH$.

6. The compound as claimed in claim 1, in which R^6 is $-\overset{O}{\overset{\|}{C}}-O-CH_3$.

7. The compound as claimed in claim 1, in which R^6 is $-\overset{O}{\overset{\|}{C}}-OH$.

8. The compound as claimed in claim 1, in which R^4 and R^5 are both $-CH_3$.

9. A compound of the general formula



and the pharmaceutically acceptable salts thereof, wherein R^1 is hydroxy, R^2 and R^3 are both $-CH_2-\overset{O}{\overset{\|}{C}}-O-CH_3$

for one hour until cl ar, then diluted with H_2O and extracted with ether. The ether was washed w ll with dilute HCl (until the starch-iodide test for peroxide was negative) then extracted with dilute NaOH. This basic solution was brought to pH 2 with dilute HCl, then extracted with ether which was dried and evaporated; the yellow glass was dried at 30°/0.5 mm: this produced 1.90 g (86%) of title compound.
Calculated for $C_{21}H_{38}O_7$: C, 62.66; H, 9.52. Found: C, 63.00; H, 9.88.

Example 11.

3-(12-Carboxy-12-methyl-tridecyl)-3-hydroxyglutaric acid.

A 0.90 g sample of the product of Example 10 dissolved in 10 mL of 10% NaOH was heated at 50° overnight. The solution was made pH 2 with dilute HCl and extracted with ether which was dried (NH_2SO_4) and evaporated. The residue dissolved and CH_2Cl_2 was filtered, evaporated and dried at 30°/0.5 mm to give the title compound as a yellow glass, 0.90 g. A portion crystallized twice from ether-pentane gave the title compound as tiny white clusters, m. 56-58°. Calculated for $C_{20}H_{36}O_7$: C, 61.83; H, 9.34. Found: C, 61.83; H, 9.45.

Example 12.

Dimethyl 3-(12-carbomethoxy-12-methyl-tridecyl)-3-hydroxyglutarate.

A 1.65 g sample of the product of Example 11 was esterified with CH_2N_2 as described for Example 9; the product was flash chromatographed on a 5 x 25 cm column of silica gel in 5% ether-CH_2Cl_2 yielding a yellow oil 0.65 g, of title product. Calculated for $C_{23}H_{42}O_7$: C. 64.15; H, 9.83. Found: C, 64.55; H, 9.69.

Example 13.

14-Allyl-14-hydroxy-2,2-dimethyl-16-heptadecen-1-ol.

A solution of 1.01 g (3.0 mmol) of the title compound of Example 7 and 2.5 g (10 mmol) of lithium tris-t-butoxyaluminum hydride in 250 mL of tetrahydrofuran under N_2 was stirred overnight at room temperature. After dilution with ether the mixture was washed sequentially with saturated solutions of Na-K tartrate, NaCl, then dried and the solvents removed. The residue was dissolved in 100 mL of Skellysolve A, decolorized with activated charcoal, the mixture filtered and the filtrate evaporated. The residue was dried at 40°/3 mm to yield 0.92 g of a cloudy oil.

Example 14.

3-(13-Hydroxy-12,12-dimethyl-tridecyl)-3-hydroxyglutaric acid.

Ozonization and oxidation of 0.80 g of the product of Example 13 prepared above using the conditions for the preparation of the product in Example 10 furnished 0.73 g of a yellow glass. Upon crystallization twice from 1:1 ether-hexane the title compound was obtained as a white crystalline powder, 0.30g, mp 102-3°.
Calculated for $C_{20}H_{38}O_6$: C, 64.14; H, 10.23.
Found: C, 64.18; H, 10.41.

While the invention has been described and illustrated with reference to certain prepared embodiments thereof, those skilled in the art will appreciate that various changes, modifications and substitutions can be made therein without departing from the spirit and scope of the invention. For example, effective dosages other than the preferred range as set forth herein above may be applicable as a consequence of variations

little loss to yield a water-white oil.
Calculated for $C_{24}H_{46}O_3$: C, 75.34; H, 12.12.
Found: C, 75.66; H, 12.35.

Example 7.

14-Ally-14-hydroxy-2,2-dimethyl-16-heptadecenal.

A solution of 43.3 g (0.113 mol) of undistilled product of Example 6, 50 mL of H_2O, and 10 mL of 2.7N HCl (0.027 mol) in 500 mL of acetone was allowed to stand under N_2 for 20 hours; TLC (20% $C_2H_5OCOCH_3$-CH_2Cl_2) showed no more product of Example 6. Solid K_2CO_3, 2.8 g (0.020 mol), was added and the solution stirred for one hour. After dilution with 75 mL of H_2O and 425 mL of acetone, 18.1 g (0.114 mol) of $KMNO_4$ was added and the mixture stirred rapidly for 4 hours until the pink color was gone, then filtered and the acetone evaporated at reduced pressure. The remaining aqueous solution was brought to pH 2 with dilute HCl and extracted with ether, which was washed once with dilute HCl and then extracted twice with dilute NaOH. The ether layer was dried (K_2CO_3), evaporated, the light-yellow oil dried at 30° /0.5 mm: producing 20.7 g (54%) of the title compound.

Example 8.

14-Allyl-14-hydroxy-2,2-dimethyl-16-heptadecenoic acid.

The NaOH extracts from the product of Example 7 were brought to pH 2 with dilute HCl and extracted with ether. These extracts were dried (Na_2SO_4), evaporated and the yellow glass dried at 30° centigrade/0.5 mm, yielding 18.4 g (46%) of the title compound. A 0.28 g-sample prepared in this manner was flash chromatographed on a 1 x 15 cm column of silica gel in 20% $C_2H_5OCOCH_3$-CH_2Cl_2 and furnished 0.13 g of the title compound.
Calculated for $C_{22}H_{40}O_3$: C, 74.95; H, 11.44.
Found: C, 74.13; H, 11.11.

Example 9.

Methyl l4-allyl-14-hydroxy-2,2-dimethyl-16-heptadecenoate.

A cooled ether solution of 2.4 g of the product of Example 8 was added to excess CH_2N_2 in ether at 0 to 5°; after standing 2 hours, the excess CH_2N_2 was decomposed with dilute HCl. The ether layer was washed with H_2O, with dilute $NaHCO_3$, dried (K_2CO_3) and evaporated. The residue, 2.5 g, was flash chromatographed on a 10 x 20 cm column of silica gel in 20% $C_2H_5OCOCH_3$-CH_2Cl_2; a single fraction of 0.37 g was used for; a total of 1.35 g of title compound was obtained as a light-yellow oil.
Calculated for $C_{23}H_{42}O_3$: C, 75.36; H, 11.55.
Found: C, 74.86; H, 11.47.

Example 10.

3-(12-Carbomethoxy-12-methyl-tridecyl)-3-hydroxy-glutaric acid.

Ozone/O_2 was bubbled into a solution of (2.0 g 5.46 mmol) of the product of Example 9 and 4 mL of CH_3COOH in 100 mL of CM_2Cl_2 at -70° until the blue color persisted, then O_2 was continued until clear. After adding 4 mL of CH_3COOH, the CH_2Cl_2 was removed at reduced pressure and 10 mL of CH_3COOH, 8 mL of H_2O, 5 ml of 10% H_2SO_4 and 5 mL of 30% H_2O_2 were added. This mixture was heated at 70 - 75°

A suspension of 90g (0.61mol) of the product of Example 2 and 250mg (0.66 mol) of pyridinium dichromate was stirred rapidly in 2L of CH_2Cl_2 for 40 hours. The mixture was filtered through Celite, the filtrate passed through a column of Florisil and the solvent evaporated. Distillation of the r sidue through a 45cm vigreux column furnished the title compound as a water-white oil bp 65 - 68°/10mm, 31.4g (35%).
Calculated for $C_7H_{14}O_3$: C,57.51; H, 9.65. Found: C, 57.69; H, 9.85.

Example 4.

Methyl 14,14-dimethoxy-13,13-dimethyl-11-tetradecenoate.

A mixture of 10.5gm (0.42mol) of NaH (as a 50% suspension in mineral oil) and 400 mL of dimethylsulfoxide (DMSO) was stirred and heated at 60° under nitrogen until the evolution of gas ceased, then cooled to and maintained at 20 to 25° while adding dropwise a solution of 111.0g (0.21 mol) of the product in Example 1 in 200 mL of DMSO. When this addition was complete, 600 mL of tetrahydrofuran (THF) was added and the suspension was cooled to 0 to 5° centigrade. A solution of 43.8g (0.30mol) of the product of Example 3 in 200 mL of THF was added over two minutes and the mixture was stirred rapidly and allowed to warm to room temperature overnight. Methyl iodide, 15.2g (0.25mol) was added, the mixture stirred for 8 hours, then an equal quantity of methyl iodide was added and stirring continued for 60 hrs. After adding 30 mL of MeOH and 20g of K_2CO_3 the lower-boiling solvents were evaporated at reduced pressure, and the remaining DMSO-solution was diluted with water and extracted with ether. This extract was washed well with water, dried (K_2CO_3), concentrated to 1L, and cooled. The white cystals that separated were filtered off and dried: 27.6g, mp 155 - 156°: triphenylphosphine oxide. The filtrate was evaporated, the residue stirred with 2L of pentane, and an additional 13.4g of the oxide was filtered off. After evaporation of the solvent, the residue was flash chromatographed twice on 10 x 30cm columns of silica gel in CH_2Cl_2. Distillation of the appropriate combined fractions furnished the title compound as a water-white oil bp 151 - 156°/0.2 mm, 38.7g 56%).
Calculated for $C_{19}H_{36}O_4$: C, 69.47; H, 11.05.
Found: C, 69.54; H, 11.20.

Example 5.

Methyl 14,14-dimethoxy-13,13-dimethyltetradecanoate.

A solution of 38.7g (0.12mol) of the product of Example 4 in THF was reduced with H_2 at 60 psi using 5% Pd on C at 25°. After filtering off the catalyst, the solvent was evaporated, the residue dissolved in pentane, and again filtered and evaporated. Distillation of the residue furnished the title compound as a water-white oil, bp 153 to 168° 0.1 mm, 38.0g (98%). Calculated for $C_{19}H_{38}O_4$: C, 69.03; H, 11.59. Found: C, 69.30; H, 11.84.

Example 6.

17,17-Dimethoxy-16,16-dimethyl-4-allyl-4-hydroxy-heptadecene-1.

A crystal of iodine, 1 ml of commercial allyl magnesium bromide in ether and 0.5 g of allylbromide were added to a stirred suspension of 6.35 g (0.26 mol, 15% excess) of Mg turnings in 800 mL of dry THF at reflux. When the yellow color cleared, a solution of 31.6 g (0.26 mol) of allylbromide and 37.5 g (0.113 mol) of the product of Example 5 in 200 mL of THF was added dropwise in 45 minutes. After heating for an additional hour, the solution was cooled then d composed with 10 ml of methanol. After dilution with ether, sufficient saturated NH_4Cl solution was added to dissolve the Mg salts, the organic layer was separated, washed with saturated NaCl solution, dried (K_2CO_3), and vaporated at reduced pressure to give the product as a yellow oil, 43.8 g which was sufficiently pure for the subsequent step.

A 0.5 g portion of this material was distilled in a short-path apparatus at 0.1 mm, bath 170-190°, with

type of lipoprotein. The various disorders are classified in terms of specific types of lipoproteins whose concentrations are altered, rather than simply in terms of the concentrations of the associated lipids.

Among the numerous recognized risk factors for the development of atherosclerosis, one of the best documented is the association between the concentrations of lipids in blood and the development of coronary heart disease. The evidence for the association between cholesterol concentrations in plasma and coronary heart disease is extensive and unequivocal (Task Force on Arteriosclerosis, 1977 Department of Health, Education, and Welfare publication number 78-1526). The strength of this evidence is based on numerous sources, including 1) the experimental production of atherosclerotic lesions in animal fed diets that induce hypercholesterolemia, 2) knowledge of the nature and dynamics of the human atherosclerotic plaque, 3) the occurrence of hyperlipidemia in groups of subjects with clinically manifested atherosclerotic disease, 4) the study of genetic hyperlipidemia that is associated with premature coronary heart disease, and 5) epidemiological studies of populations with different concentrations of cholesterol in plasma.

Concentrations of LDL in plasma correlate closely with the concentrations of cholesterol, since 60 to 75% of the total cholesterol in plasma is normally transported in association with this lipoprotein. Thus, concentrations of LDL or cholesterol carry more or less the same predictive power for assessment of risk of coronary heart disease.

The following non-limiting examples further illustrate details for the preparation of the compounds of the present invention. Those skilled in the art will readily understand that known variations of the conditions and processes of the following preparative procedures can be used to prepare these compounds. All temperatures are degrees Celsius unless otherwise noted. Melting points were determined on a Thomas-Hoover Unimelt capillary apparatus and are not corrected. Unless otherwise noted, IR and NMR spectra, taken over $CHCl_3$, were consistent with the assigned structure. The latter were recorded at 60 MHz with chemical shifts expressed in parts per million down field from the internal standard $(CH_3)_4Si$.

Example 1.

10-Carboxydecyl triphenylohosphonium bromide.

A solution of 303 g (1.14 mol) of 11-bromoundecanoic acid and 303 g (1.16 mol) of triphenylphosphine in 3L of toluene was stirred and refluxed under N_2 for three days, then cooled to 0°. The crystalline solid was broken up, filtered off, washed with toluene and with ether, and then dissolved in a minimum of CH_2Cl_2. This solution was diluted with stirring to 4L with ether, the white crystalline powder was filtered off and dried at 40°/1 ml; 524 g (87%), mp 95-98°.
Calculated for C_{29} H_{36} BrO_2P: C, 66.03; H, 6.88.
Found: C,66.36; H, 6.95.

Example 2.

3,3-Dimethoxy-2,2-dimethylpropanol.

A solution of 24.4 g 0.24 mol) of 3-hydroxy-2,2-dimethylpropanal (Aldrich), 26 g (0.25 mol) of trimethyl orthoformate, and 0.5 mL of 6.8 N HCl/dioxane in 300 mL of methanol was allowed to stand at room temperature overnight. A slight excess of $NaOCH_3$ was added and the solvent evaporated at reduced pressure. The residue was dissolved in ether and the mixture filtered. After evaporation of solvent and fractionation twice through a 15 cm Vigreux column, the product was obtained as a water-white oil, bp 43-48°/0.2mm, 18.5g (52%).

Calculated for $C_7H_{16}O_3$: C, 56.73; H, 10.88.
Found: C, 56.79; H; 10.78.

Example 3.

3,3-Dimethoxy-2,2-dimethylpropanal.

10:00 a.m., to compensate for any diurnal rhythms such as glycogen depl tion.

The cells are suspended in 2 mls of Krebs-Henseleit buffer supplemented with 2% BSA (essentially fatty acid free and dialyzed) under an atmosphere of 95% O_2, 5% CO_2 in stoppered 25 ml Erlenmeyer flasks. Incubations were conducted in a shaking water bath at 37° C for appropriate times. Cells for fatty acid and cholesterol synthesis were treated with 50 liters of H_2O(10mCi/ml) after 30 minutes of pre-incubation and stopped at 60 minutes.

Assay of metabolites: Cells are terminated with $HClO_4$(0.1ml of 60%) and treated as described previously; McCune et al., 1981 Methods of Enzymology 72, 557-559). The metabolites in the extracts are measured spectrophotometrically by enzymatic methods, according to the methods of Hohorst et al. (1959 Biochem. Z., 332,18-46) for pyruvate and lactate, Williamson et al. (1962) for acetoacetate and beta-hydroxybutyrate, Slein (1965) for glucose, Michal and Bergmeyer (1974) for acetyl-CoA, McCune, et al. (ibid) for glycogen, Mollering and Gruber 1966 Anal. Biochem. 17, 369-379) for citrate, and Lambrecht and Trautschold (1974 Methods of Enzymatic Analysis, 2101-2109) for ATP.

Determination of cholesterol and fatty acid synthesis: The rate of fatty acid synthesis and cholesterol synthesis, expressed as moles of acetate equivalents/g wet weight of hepatocytes are determined by the incorporation of H_2O into total lipid, and extracted by the methods of Kates (1972 Tech. of Lipidology, 349, 363) and Harris (1975 Arch. Biochem. Biophys. 169, 168-180). Calculations are done according to Jungas (1968 Biochemistry 7, 3708-3717).

Various compounds of the present invention were added to various concentrations to the hepatocytes and incubated for a short period of time. The effect of the compound was evaluated on cholesterol, fatty acid and glucose synthesis as well on other metabolites in the cell.

Summary of effects of various compounds on metabolism in fed hepatocytes

Compound	Dose(mM)	Fatty Acid Synthesis**	Cholesterol Synthesis**	Glucose Release**	Lactate***	Pyruvate***
No Addition	-	0.024±0.004	0.013±0.002	0.787±0.041	0.317±0.095	0.186±0.040
Prior Art Compound*	0.5	0.010±0.002	0.010±0.002	1.507±0.047	0.383±0.085	0.110±0.013
Example 10	0.5	0.003±0.001	0.003±0.001	1.357±0.009	0.477±0.084	0.220±0.031
Example 11	0.5	0.003±0.001	0.002±0.001	1.014±0.099	0.437±0.104	0.202±0.028
Example 14	0.5	0.003±0.001	0.004±0.001	1.492±0.051	0.400±0.091	0.185±0.042

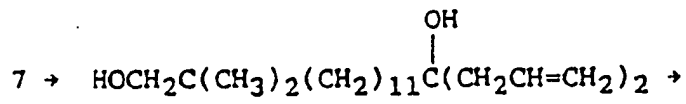
* Compound disclosed in U.S. Pat. No. 4,645,858, Example 19 (3-hydroxy-3-[12,12-dimethyltridecyl]glutaric acid)

** mmoles/min/gm wet weight

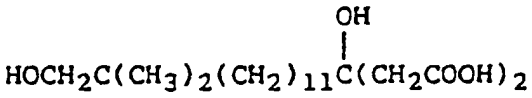
*** mmoles/ml incubation medium

With increased interest in the prevention of coronary heart disease and the recognition of the role of hyperlipoproteinemia as a risk factor, the search has been on to increase the number of drugs available for the treatment of hyperlipidemia. Treatment of the patient with hyperlipidemia has become more precise as knowledge of lipid metabolism and of the mechanism of action of hypolipidemic drugs has increased. The routine clinical measurement of the concentrations of cholesterol and triglycerides in plasma, which has become widespread, from its identification of patients with asymptomatic hyperlipidemia and has allowed recognition of the assocation of hyperlipidemia with such conditions as abdominal pain, pancreatitis, xanthomatosis, and premature vascular disease. These factors have emphasized the need for means to manage hyperlipidemia in the safest and simplest manner.

Hyperlipidemia is a sign of a heterogenous group of diseases that differ in etiology, clinical manifestations, prognosis, and response to therapy. Understanding of the various hypolipidemias requires knowledge of the different types of lipoproteins that circulate in plasma, since it is in association with these proteins that nearly all lipids in plasma (except free fatty acids) are found. The major plasma lipids, including cholesterol and tryglycerides, do not circulate fr ely in solution, but rather are transported in blood in the form of complexes with lipoproteins. Th major families of lipoproteins are the chylomicrons, very-low-density lipoproteins (VLDL), int rmmediat density lipoproteins (IDL), low-density lipoproteins (LDL), and high-density lipoproteins (HDL). Thus, the measurement of total cholesterol and triglyceride concentrations in plasma is inadequate for diagnosis and as a guide to therapy, since reciprocal changes in the concentration of different classes of lipoproteins may mask the presence of an abnormality of an individual



13



14

The compounds of the present invention can be administered in such oral dosage forms as tablets, capsules, pills, powders, granules, elixirs, tinctures, suspensions, syrups, emulsions, and suspensions. Likewise they may also be administered in intravenous, intraperitoneal, subcutaneous, or intramuscular form, all using forms known to those of ordinary skill in the pharmaceutical arts. In general, the preferred form of administration is oral. An effective but non-toxic amount of the compound is employed in the treatment of hyperlipoproteinemias, and in particular in the treatment of Type II hyperlipidemia with resultant lowering of low density lipoproteins, and concomitant reduction in serum cholesterol levels. The dosage regimen utilizing the compounds of the present invention is selected in accordance with a variety of factors including the type, species, age, weight, sex, and medical condition of the patient; with the severity of the condition to be ameliorated, the route of administration, the renal and hepatic function of the patient, the route of administration and the particular compound employed or mixtures thereof. An ordinarily skilled veterinarian or physician can readily determine and prescribe the effective amount of the drug required to prevent, treat or arrest the progress of the condition.

Dosages of the compounds of the present invention, when used for the indicated hypolipidemic effects, will range between about 1 mg/kg/day to about 200 mg/kg/day and preferably 2.5 to 25 mg/kg/day. Advantageously, the compounds of the present invention may be administered in a single daily dose or the total daily dosage may be administered in equal divided doses of 2, 3 or 4 times daily.

In the pharmaceutical compositions and methods of the present invention, the foregoing compounds described in detail above will form the active ingredients and will typically be administered in admixture with suitable pharmaceutical diluents, excipients, or carriers (collectively referred to herein as "carrier" materials) suitably selected with respect to the intended form of administration, that is, oral tablets, capsules, elixirs, syrups, and the like, and consistent with conventional galenical and pharmaceutical practices.

For instance, for oral administration in the form of tablets or capsules, the active drug components may be combined with an oral non-toxic pharmaceutically acceptable inert carrier such as lactose, starch, sucrose, glucose, methylcellulose, magnesium stearate, dicalcium phosphate, calcium sulfate, mannitol, sorbitol and the like; for oral administration in liquid form, the active drug components may be combined with any oral non-toxic pharmaceutically acceptable inert carrier such as ethanol glycerol, water, and the like. Moreover, when desired or necessary, suitable binders, lubricants, disintegrating agents and coloring agents can also be incorporated in the mixture. Suitable binders include starch, gelatin, natural sugars such as glucose, or β-lactose, corn sweeteners, natural and synthetic gums such acacia, tragacanth or sodium alginate, carboxymethylcellulose, polyethylene glycol, and waxes. Lubricants for use in these dosage forms include boric acid, sodium benzoate, sodium acetate, sodium chloride, and the like. Disintegraters include, without limitation, starch, methylcellulose, agar, bentonite, xanthan gum and the like.

HYPOLIPIDEMIC ACTIVITY

The compounds of this invention exhibit hypolipidemic activity as determined in the isolated hepatocyte system. The test procedures employed to measure hypolipidemic activity of the compounds of the present invention are described below.

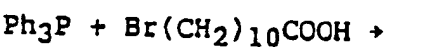
Hepatocytes are prepared from ad lib fed rats or 48-hour fasted rats by the method of Berry and Friend (1969) with minor modifications (McCune and Harris, 1979 J. Biol. Chem. 254,10095-10101.) Lean female rats (200-300 g) are ad lib fed and on a 8:00 a.m.-8:00 p m light cycle. The cells are isolated between 9:00-

11

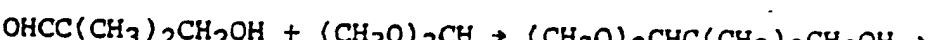
(10→12)

12

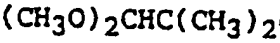
Scheme 2



1



2



3

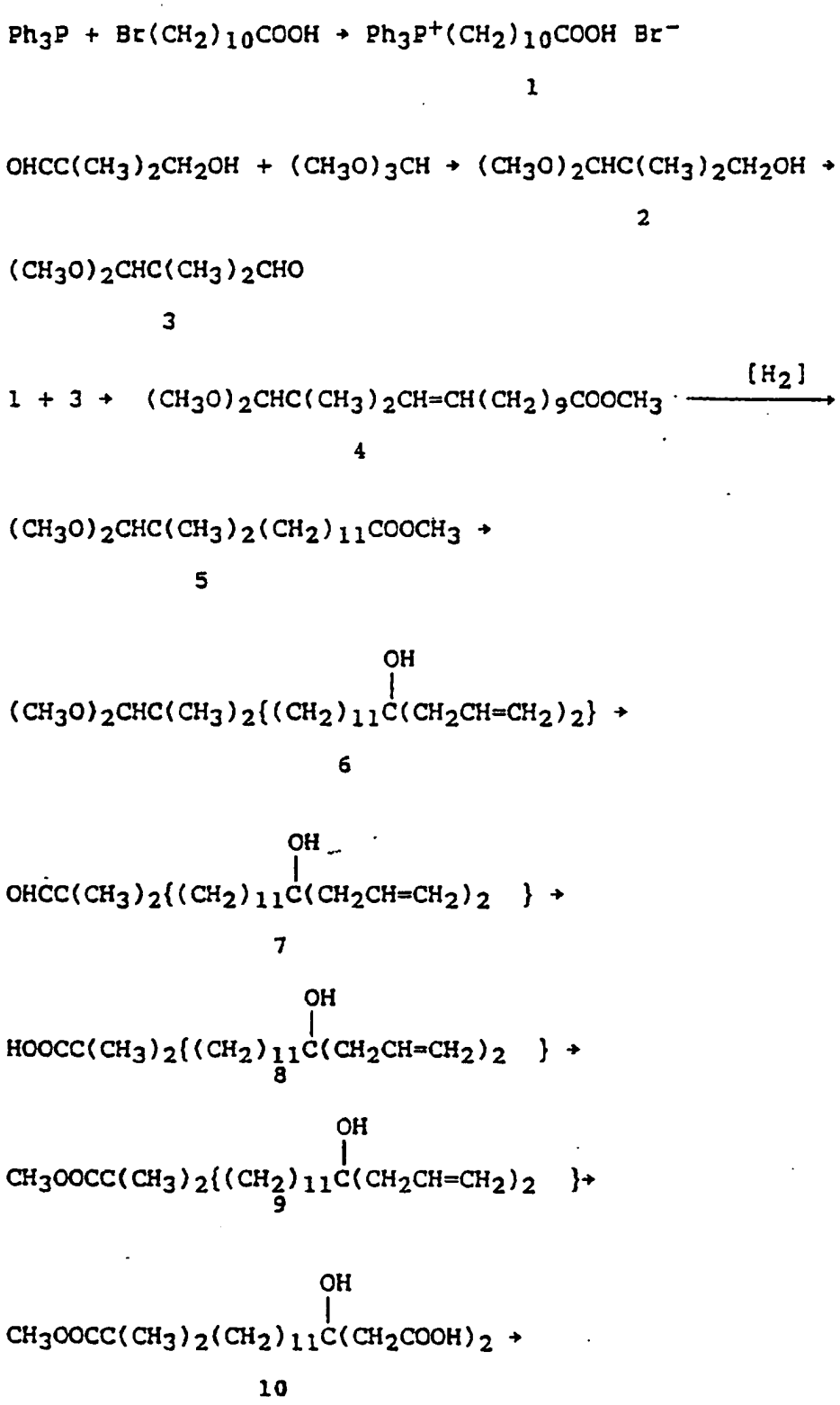
4

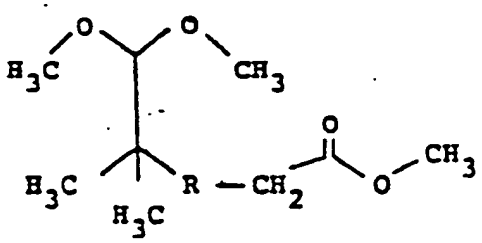
5

6

7

Scheme 1

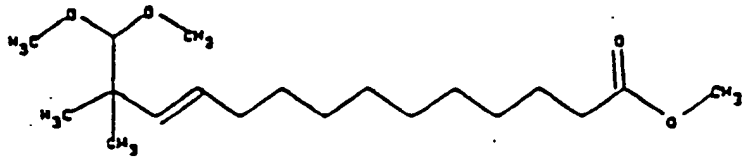

Ph3P + Br(CH2)10COOH → Ph3P+(CH2)10COOH Br−
1
OHCC(CH3)2CH2OH + (CH3O)3CH → (CH3O)2CHC(CH3)2CH2OH →
2
(CH3O)2CHC(CH3)2CHO
3
1 + 3 → (CH3O)2CHC(CH3)2CH=CH(CH2)9COOCH3
[H2]
4
(CH3O)2CHC(CH3)2(CH2)11COOCH3 →
5
OH
(CH3O)2CHC(CH3)2{(CH2)11C(CH2CH=CH2)2} →
6
OH
OHCC(CH3)2{(CH2)11C(CH2CH=CH2)2 } →
7
OH
HOOCC(CH3)2{(CH2)11C(CH2CH=CH2)2 } →
8
OH
CH3OOCC(CH3)2{(CH2)11C(CH2CH=CH2)2 }→
9
OH
CH3OOCC(CH3)2(CH2)11C(CH2COOH)2 →
10



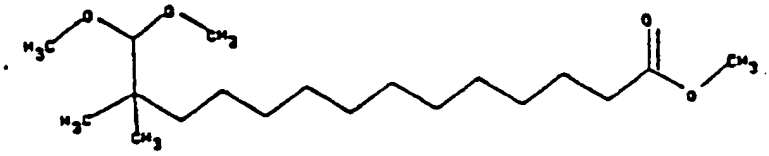
(V)

and the pharmaceutically acceptable salts thereof, wherein R is an alkane or alkene of 3 to 15 carbon atoms, with one or more degrees of unsaturation where R is alkene.

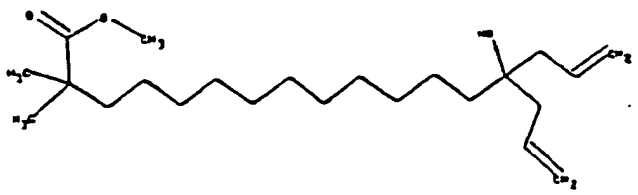
Most especially preferred compounds falling within general Formula V are those wherein R is undecane or undecene and which are namely methyl 14, 14-dimethoxy-13, 13-dimethyl-11-tetradecenoate



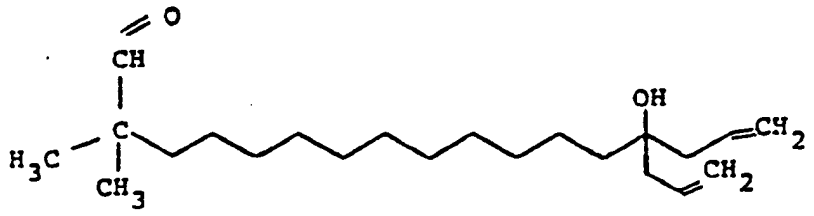
and Methyl-14,14-dimethoxy- 13,13-dimethyl tetradecanoate.



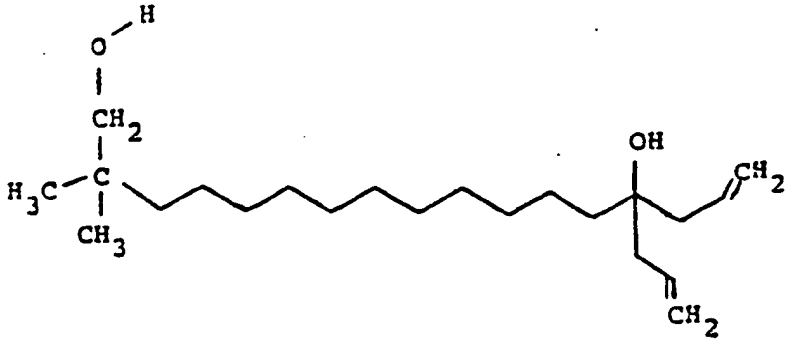
The compounds of the invention can be prepared by methods which are in themselves known, such as are described in the literature (for example Narayanan, K.S.; Berlin, K.D. J. Org. Chem. 1980, 45,2240; Johnson, P.R.; White, J.D. J. Org. Chem. 1984, 49,4424; or White, J.D.; Avery, M.A.; Choudry, S.C.; Dhingra, O.P.; et al.; J. Am. Chem. Soc. 1983, 105,6517), namely under reaction conditions which are known and suitable for the reactions mentioned. In these reactions, it is also possible to make use of variants which are in themselves known, but are not mentioned here in greater detail. The compounds of the invention are readily prepared according to one of the following reaction schemes or modifications thereof using readily available starting materials, reagents and conventional synthesis procedures. As used herein, Ph means phenyl.



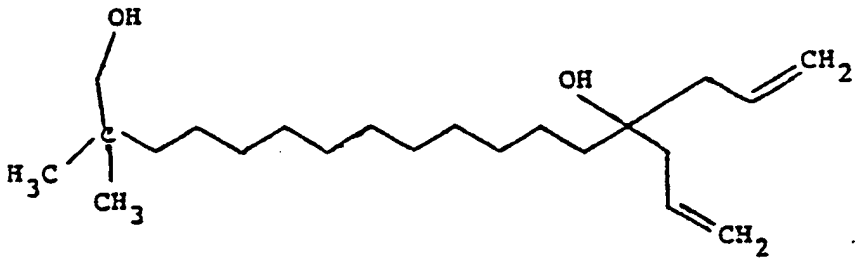
14-Allyl-14-hydroxy-2, 2-dimethyl-16-heptadecenal;



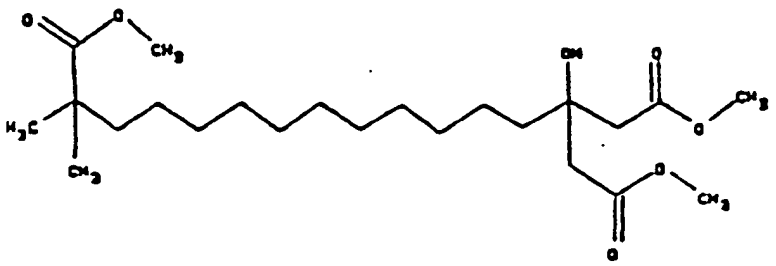
14-Allyl-14-hydroxy-2, 2-dimethyl-16-heptadecenoic acid;



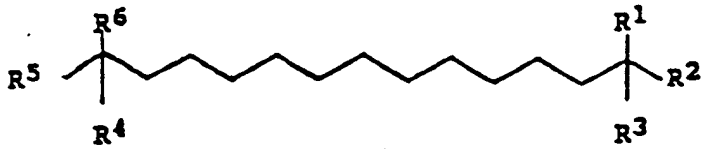
and 14-Allyl-14-hydroxy-2,2-dimethyl-16-heptadecen-1-ol.



Thirdly representative of compounds of the claimed invention are those of the general Formula V



Secondly representative of preferred compounds of the present invention are those of the general Formula IV:



(IV)

and the pharmaceutically acceptable salts thereof, wherein R^1 and R^6 are independently -H,

$-(CH_2)_n-O-H$, $-(CH_2)_n-\overset{O}{\overset{\|}{C}}H$,

$-(CH_2)_n-C-\overset{O}{\overset{\|}{O}}H$,

$-(CH_2)_n-C-\overset{O}{\overset{\|}{O}}-R^7$, $-CH(OCH_3)_2$

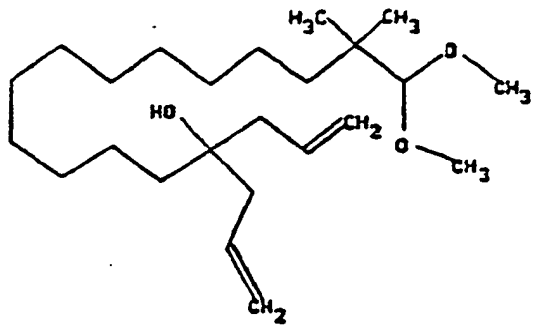
wherein R^7 is alkyl of from 1 to 10 carbon atoms, and n is an independent integer of from 0 to 10; wherein R^2 and R^3 are alkyl or alkenyl of from 1 to 5 carbon atoms; and wherein R^4 and R^5 are independently alkyl of from 1 to 10 carbon atoms.

Especially preferred compounds found within the general formula of IV are those wherein R^1 is -OH; R^2 and R^3 are both

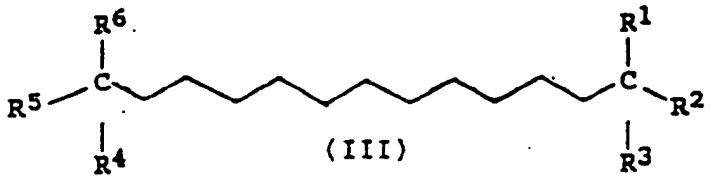
$-CH_2-CH=CH_2$;

R^4 and R^5 are both $-CH_3$; or R^6 is -H or $-CO_2CH_3$.

Most especially preferred compounds that fall within the structure of general Formula IV are 17, 17-Dimethoxy-16,16-dimethyl-4-allyl-4-hydroxy-heptadecene;



Methyl 14-Allyl-14-hydroxy-2, 2-dimethyl-16-heptadecenoic acid;



(III)

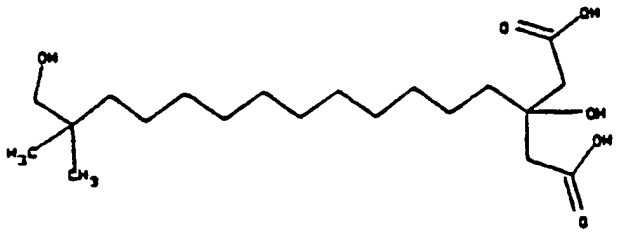
and the pharmaceutically acceptable salts thereof wherein R^1 is hydroxy, R^2 and R^3 are both

$-CH_2-\overset{O}{\overset{\|}{C}}-O-CH_3$

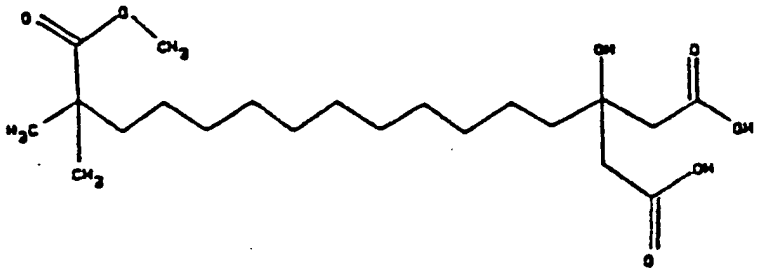
or $-CH_2-\overset{O}{\overset{\|}{C}}-OH$, R^4 and R^5 are both methyl and R^6 is selected from the group consisting of hydroxy, carboxy, methoxycarbonyl, or $-CH_2-OH$,

and which are:

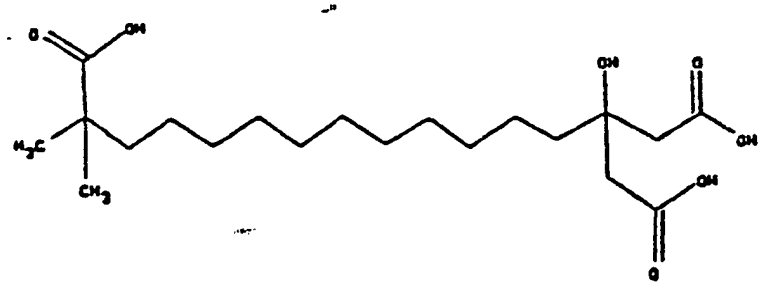
3-(13-Hydroxy-12,12-dimethyl-tridecyl)-3-hydroxy glutaric acid;



3-(12-Carbomethoxy-12-methyl-tridecyl)-3-hydroxy glutaric acid;



3-(12-Carboxy-12-methyl-tridecyl)-3-hydrdoxy glutaric acid;



and Dimethyl 3-(12-carbomethoxy-12-methyl-tridecyl)-3-hydroxy glutarate.

and the pharmaceutically acceptable salts thereof, wherein R^1, R^2, R^3 and R^6 are independently -H, $-(CH_2)_n-\overset{O}{\overset{\|}{C}}-O-H$, $-(CH_2)_n-\overset{O}{\overset{\|}{C}}-O-R^7$, $-(CH_2)_n-O-\overset{O}{\overset{\|}{C}}-(CH_2)_m$, $-(CH_2)_n-O-H$, $-(CH_2)_n-\overset{O}{\overset{\|}{C}}H$, wherein R^7 is alkyl of from 1 to 10 carbon atoms, n and m ar independent integers of from 0 to 10; wherein R^4 and R^5 are independently alkyl of from 1 to 10 carbon atoms, and p is an independent integer of from 9 to 13 carbon atoms.

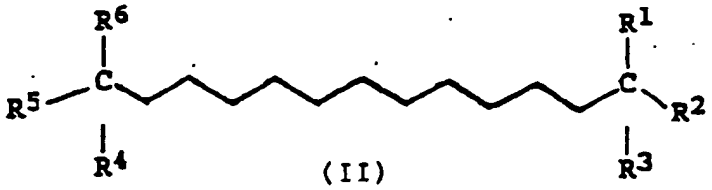
The compounds and pharmaceutical compositions thereof are useful in the hypolipidemic methods of the invention.

Detailed Description of the Invention

As used herein the expressions "alkyl" and "alkenyl" are defined to include straight or branched carbon-carbon linkages having the number of carbon atoms indicated. Representative alkyl moieties of any of the substituent groups include methyl, ethyl, propyl, butyl, pentyl, sec-butyl, tert-butyl, isopropyl, hexyl, heptyl, octyl, nonyl, decyl, etc. and the corresponding other isomeric forms thereof. Representative alkenyl moieties of any of the substituent groups include any of the aforementioned alkyl moieties bearing one or more degrees of unsaturation at any carbon-carbon linkage. Again, other corresponding isomeric forms are included, such as geometric isomers, diastereoisomers and enantiomers.

The compounds herein may also be prepared as addition salt forms thereof and such forms are included in the present compound formulas. Typical of such "pharmaceutically acceptable salts" are those non-toxic pharmaceutically acceptable salts such as sodium, potassium, ammonium and calcium.

Primarily representative of more preferred compounds in accordance with the present invention are those wherein the compound has the general formula II:



(II)

and the pharmaceutically acceptable salts thereof, wherein R^1, R^2, R^3 and R^6 are as defined above, and wherein R^4 and R^5 are independently alkyl of from 1 to 10 carbon atoms.

The especially preferred embodiments of this invention include those compounds as described above, in which R^1 is -OH; R^2 and R^3 are both $CH_2-\overset{O}{\overset{\|}{C}}-OH$; R^6 is -OH; R^6 is $-CH_2-OH$; R^6 is $-\overset{O}{\overset{\|}{C}}-O-CH_3$; R^6 is $-\overset{O}{\overset{\|}{C}}-O-H$; or in which R^4 and R^5 are both $-CH_3$.

Most especially preferred compounds of the present invention are those which follow the general formula III

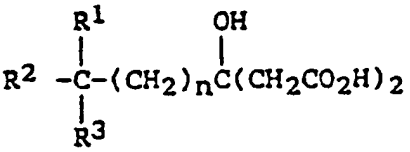
METABOLITES OF PENTANEDIOIC ACID DERIVATIVES

Background of the Invention

The present invention provides novel compounds which are pharmacologically useful as hypolipidemic drugs (e.g. those drugs which are helpful in reducing serum levels of cholesterol). More specifically, the compounds of the present invention are orally active hypolipidemic agents which promote their cholesterol lowering effects through their ability to inhibit the activity of the enzyme β-hydroxy-β-methyl-glutaryl Co-enzyme A (HMG CoA) and thus inhibit the formation of serum cholesterol. HMG CoA is a substance which controls the rate at which cholesterol is synthesized in hepatocytes (e.g., cells of mammalian liver, which are thought to be one of the two principle in vivo sources of serum cholesterol). The present invention also relates to novel pharmaceutical compositions comprising one or more of the active compounds of the invention in combination with suitable pharmaceutical carriers as well as methods of using such compounds and pharmaceutical compositions thereof in the treatment, prevention, or mitigation of hyperlipoproteinemia, including specifically type II hyperlipoproteinemia, which is characterized by an excess of serum low density lipoprotein (LDL). Thus, the compounds of the instant invention are useful to inhibit sterol biosynthesis in individuals predisposed to familial type hypercholesterolemia. The significance of such compounds is widely recognized, e.g. Breslow et al., Biochim. Biophys. Acta, 398 10 (1975); Betheridge et al., Brit. Med. J., 4,500 (1975); and Brown et al., J. Biol. Chem. 249, 7306 (1974). In addition, the compounds can be used in in vitro diagnosis (e.g. in assays for fatty acids, cholesterol, and the like).

Prior Art

The use of agents which lower serum cholesterol is widely recognized and described in the art as described above. U.S. Patent 4,645,858 discloses certain compounds, among others, of the formula



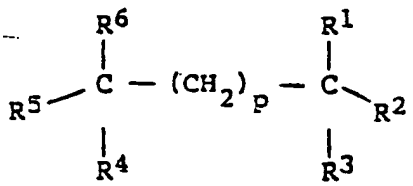
wherein R^1 is hydrogen or methyl; R^2 is methyl or ethyl; R^3 is methyl, or ethyl; and n is an integer from 8 to 13, inclusive. U.S. Patent 3,818,080 also discloses certain compounds of this class.

Summary of the Invention

The inventors believe that certain of the foregoing compounds are metabolized in vivo to the compounds of the present invention. The activity of the metabolites of the foregoing compounds has been found to be significantly greater than that of the precursor compounds.

The present invention provides compounds of the general formula I:

(I)



(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 329 124 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 89102627.0

(22) Date of filing: 16.02.89

(51) Int. Cl.[4]: C07C 59/245 , C07C 59/01 , C07C 69/675 , C07C 69/734 , C07C 69/708 , C07C 43/178 , C07C 47/263

Claims for the following Contracting State: GR.

(30) Priority: 18.02.88 US 157767

(43) Date of publication of application: 23.08.89 Bulletin 89/34

(84) Designated Contracting States: AT BE CH DE ES FR GB GR IT LI LU NL SE

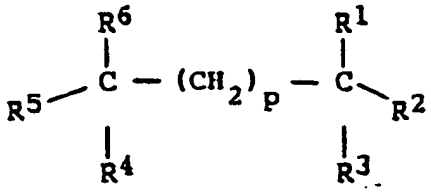
(71) Applicant: G.D. Searle & Co.
P.O. Box 5110
Chicago Illinois 60680(US)

(72) Inventor: Baran, John Stanislaus
659 Locust Street
Winnetka, IL 60093(US)
Inventor: Lowrie, Harman Smith
3863 South Mission Hills Road
Northbrook, IL 60062(US)

(74) Representative: Wolff, Hans Joachim, Dr.jur. Dipl.-Chem. et al
Beil, Wolff & Beil Rechtsanwälte Postfach 80 01 40 Adelonstrasse 58
D-6230 Frankfurt am Main 80(DE)

(54) Metabolites of pentanedioic acid derivatives.

(57) Novel metabolites of pentanedioic acid derivatives and the pharmaceutical acceptable salts thereof of the general formula



wherein
R^1, R^2, R^3 and R^6 are independently -H,

$-(CH_2)_n-\overset{O}{\overset{\|}{C}}-O-H$,

$-(CH_2)_n-\overset{O}{\overset{\|}{C}}-O-R^7$, $-(CH_2)_n-O-\overset{O}{\overset{\|}{C}}-(CH_2)_m$,

$-(CH_2)_n-O-H$, $-(CH_2)_n-\overset{O}{\overset{\|}{C}}H$,

wherein R^7 is alkyl of from 1 to 10 carbon atoms, n and m are independent integers of from 0 to 10; and wherein R^4 and R^5 are independently alkyl of from 1 to 10 carbon atoms, and p is an independent integer of from 9 to 13 carbon atoms, which are useful as hypolipidemic agents.

EP 0 329 124 A2

ANS